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Wind et al.

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(54) **LOCK WITH MOVABLE KNOB**

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(51) **Int. Cl.**

E05B 1/00	(2006.01)
E05B 13/10	(2006.01)
E05B 37/00	(2006.01)
E05B 17/04	(2006.01)
E05B 17/00	(2006.01)
E05B 5/02	(2006.01)
E05B 47/00	(2006.01)

(52) **U.S. Cl.**

CPC ***E05B 1/0092*** (2013.01); ***E05B 1/0007*** (2013.01); ***E05B 1/0015*** (2013.01); ***E05B 5/003*** (2013.01); ***E05B 13/103*** (2013.01); ***E05B 17/0041*** (2013.01); ***E05B 17/042*** (2013.01); ***E05B 37/0068*** (2013.01); ***E05B 47/0012*** (2013.01); *E05B 2001/0023* (2013.01); *E05B 2047/002* (2013.01); *E05B 2047/0021* (2013.01); *E05B 2047/0086* (2013.01); *E05B 2047/0094* (2013.01)

(58) **Field of Classification Search**

CPC E05B 1/0092; E05B 1/0007; E05B 1/0015; E05B 5/003; E05B 13/103; E05B 17/0041; E05B 17/042; E05B 37/0068; E05B 47/0012; E05B 2001/0023; E05B 2047/002; E05B 2047/0021; E05B 2047/0086; E05B 2047/0094

USPC 70/208, 210, 213, 224, 190, 277, 279.1, 70/280; 16/412

See application file for complete search history.

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Primary Examiner — Suzanne L Barrett

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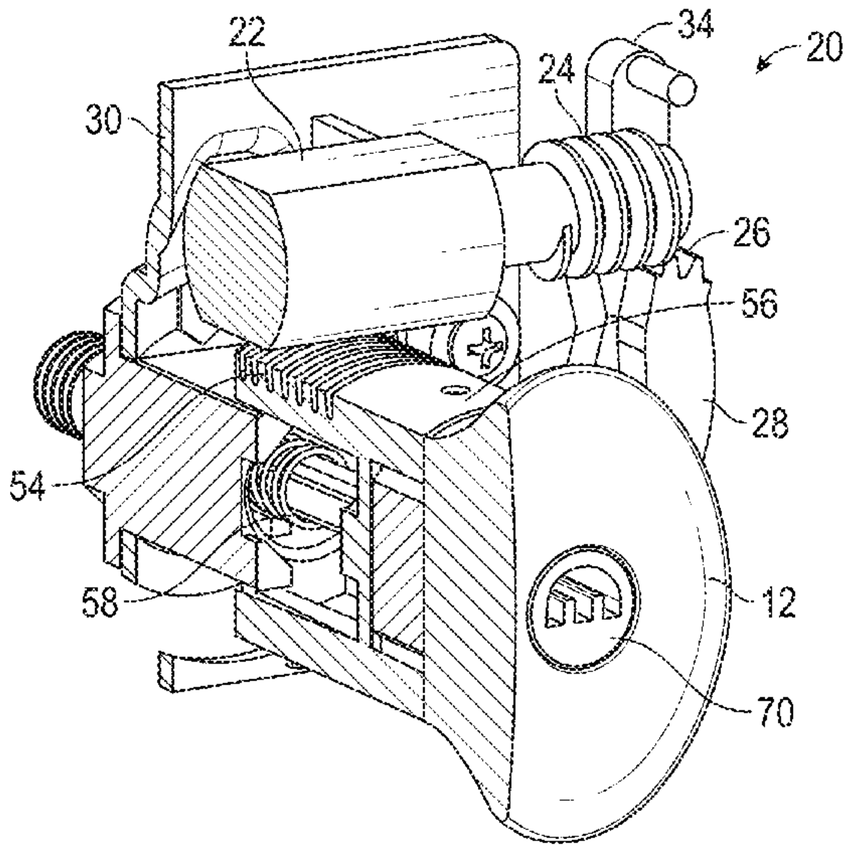
(57) **ABSTRACT**

A lock including: a retractable knob; and a knob release mechanism for retaining the retractable knob in a retracted position, the knob release mechanism retains the retractable knob in the retracted position until a motor of the knob release mechanism is actuated by an input provided to a keypad located on a surface of the lock.

18 Claims, 10 Drawing Sheets



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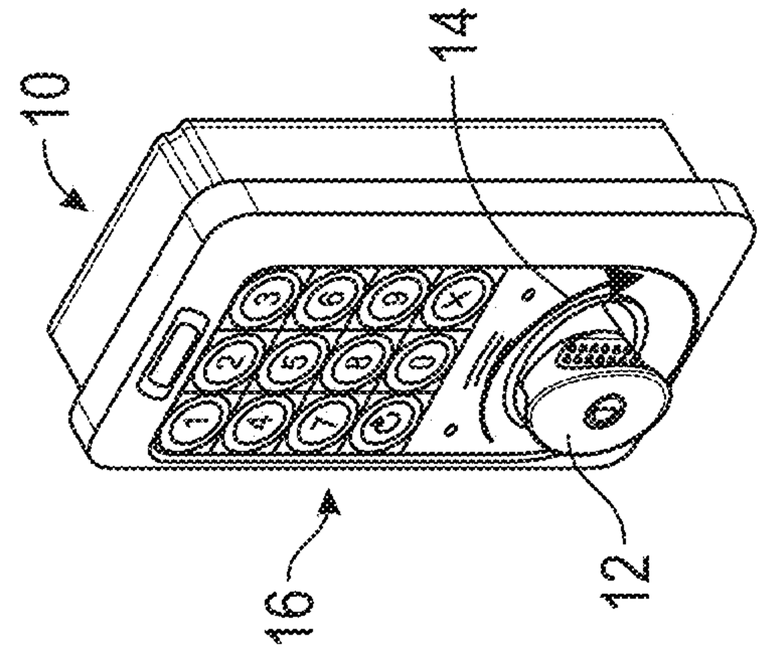

FIG. 1C

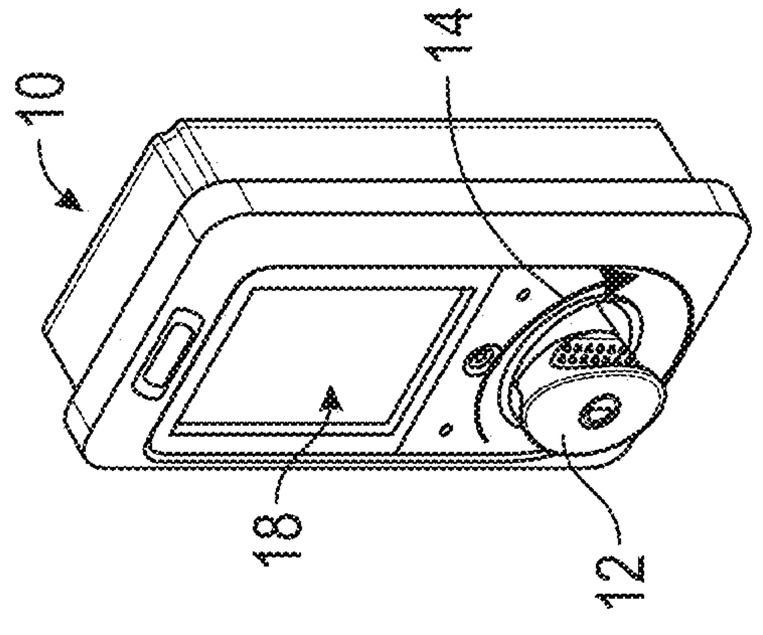

FIG. 2C

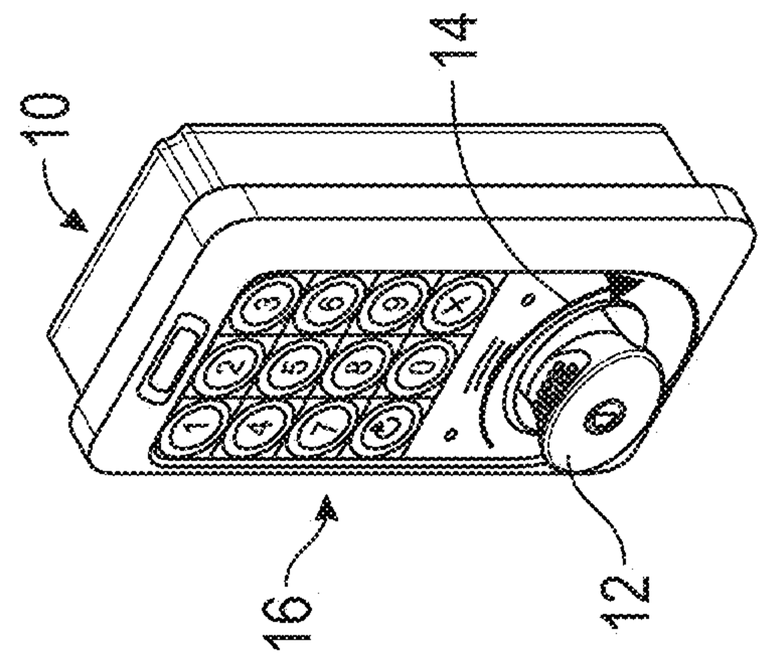

FIG. 1B

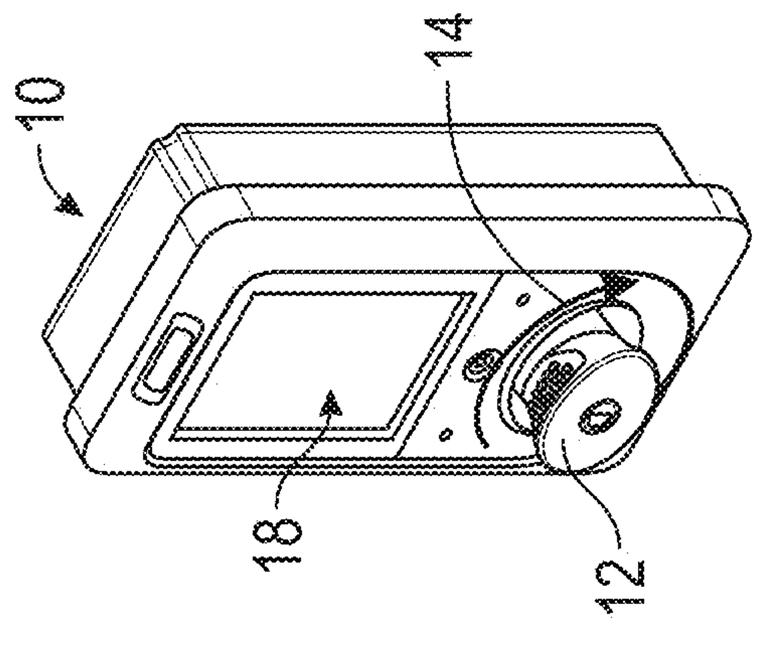

FIG. 2B

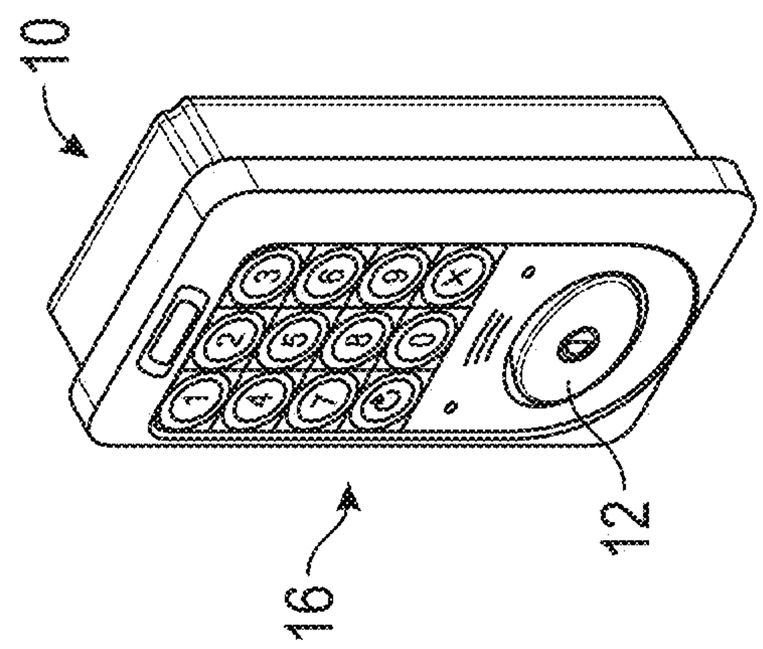

FIG. 1A

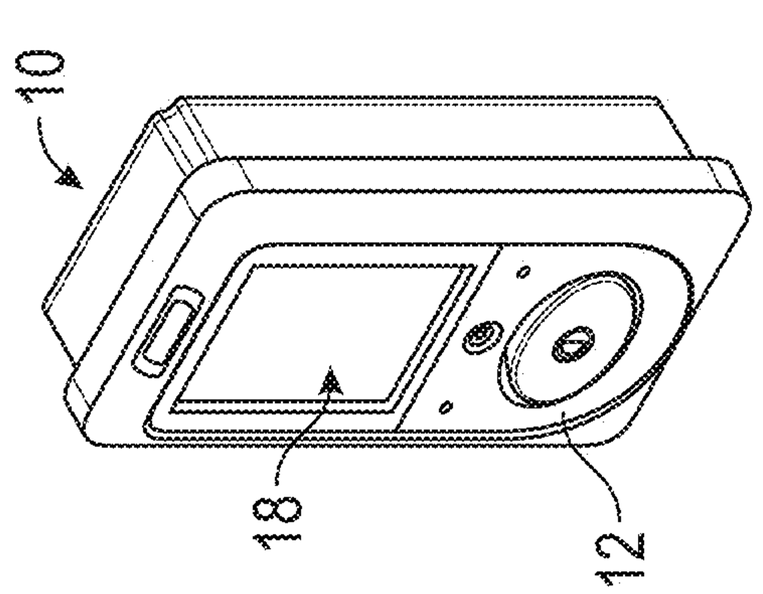

FIG. 2A

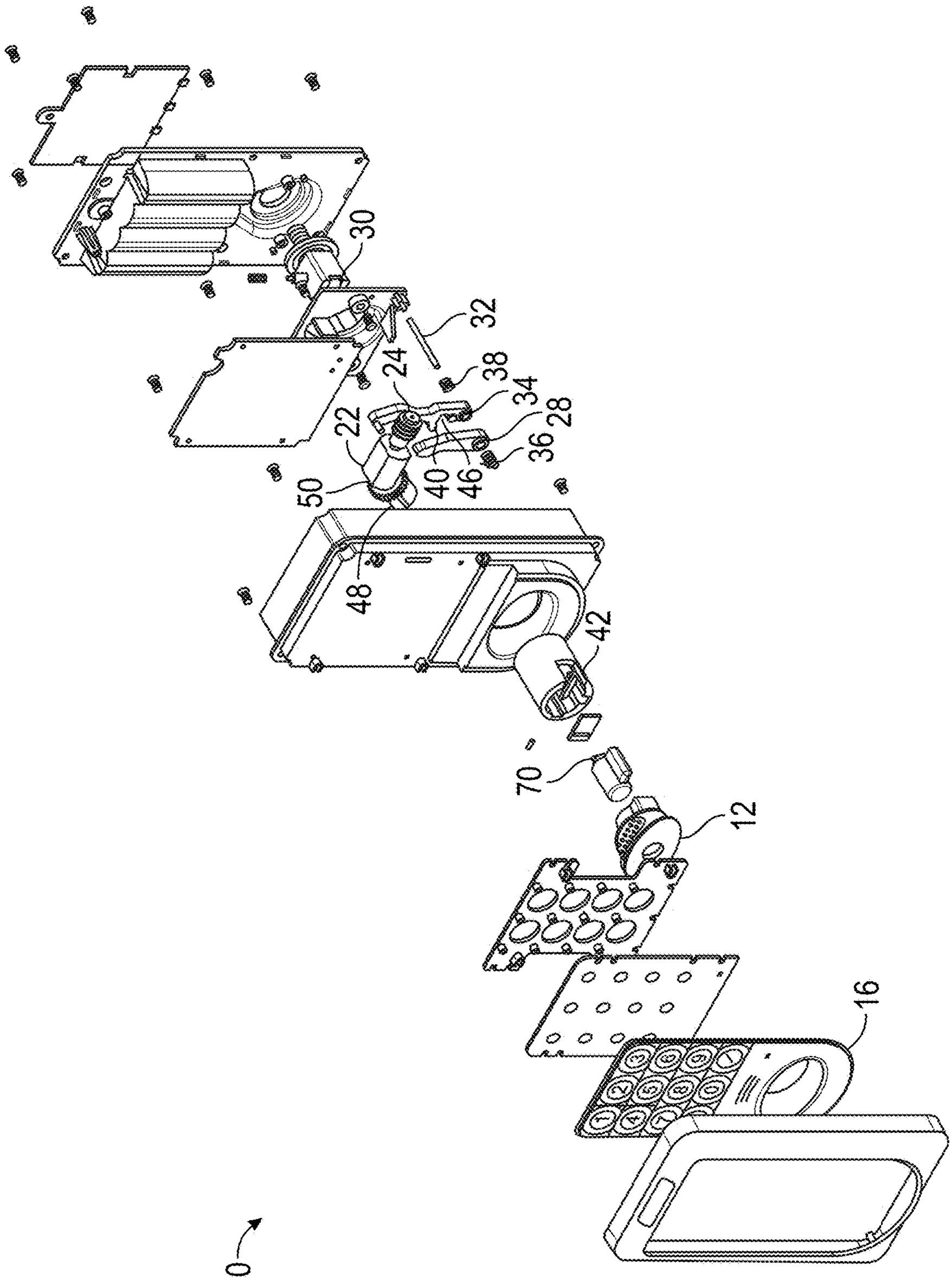

FIG. 3

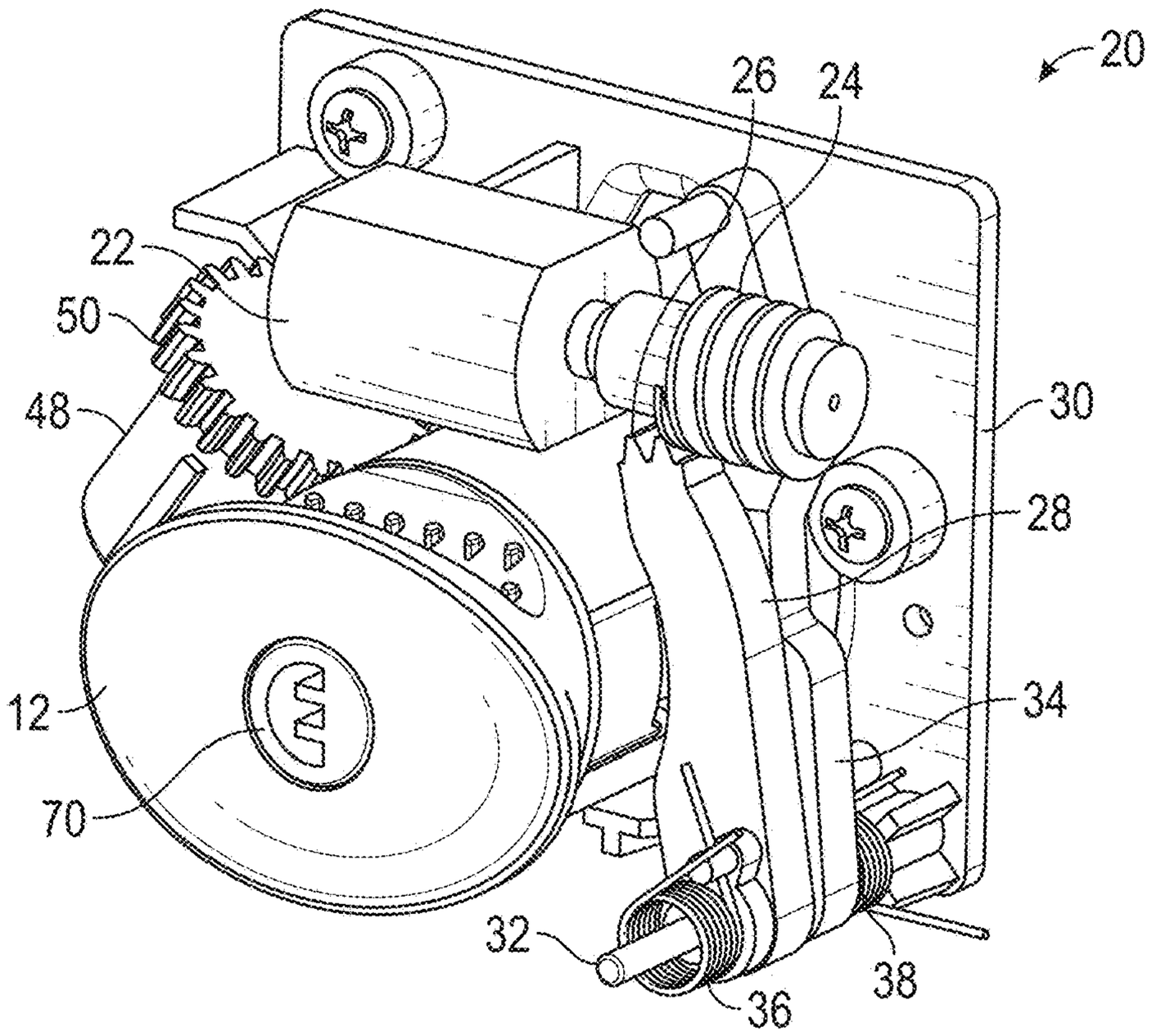
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FIG. 4

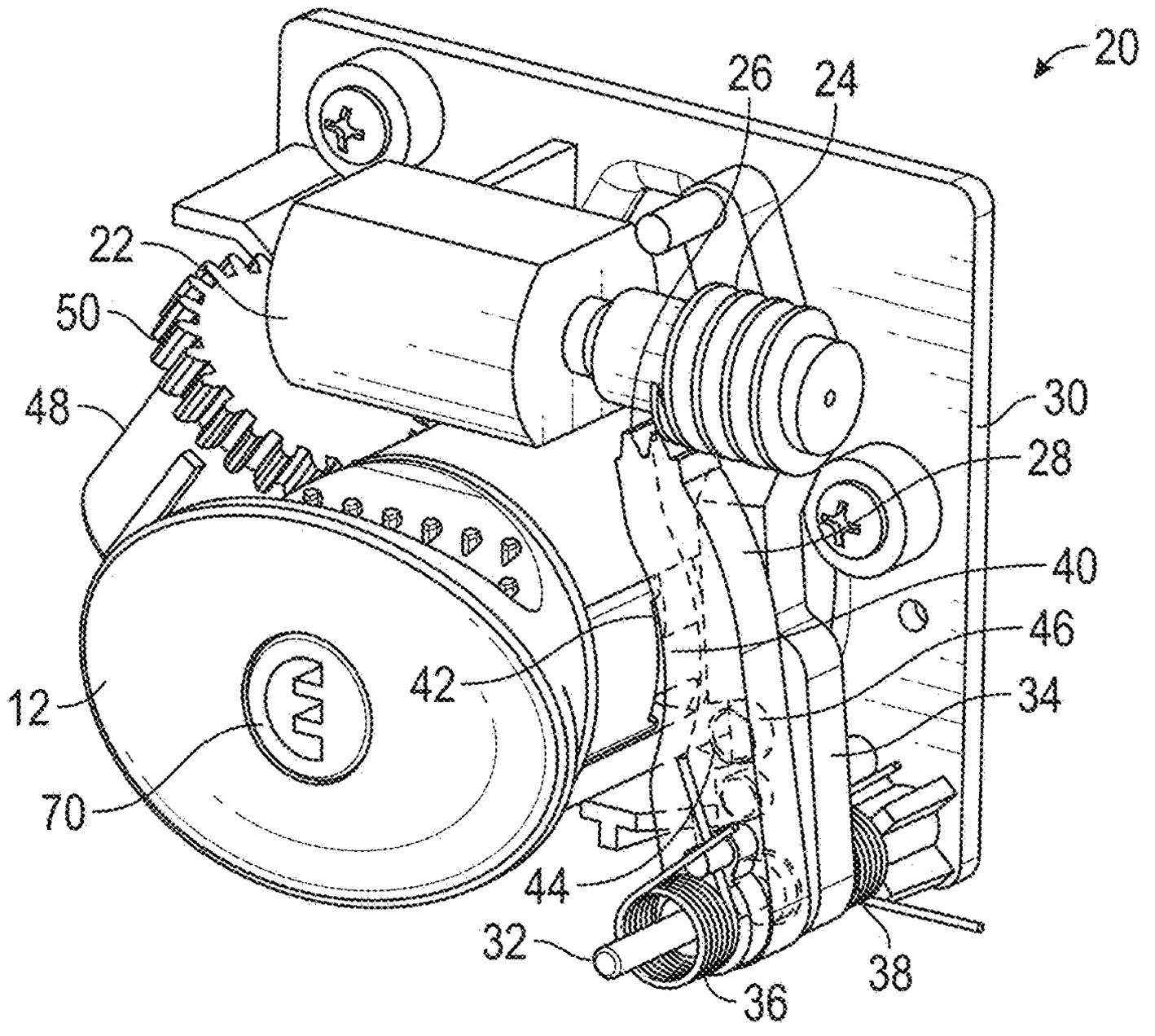
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FIG. 5

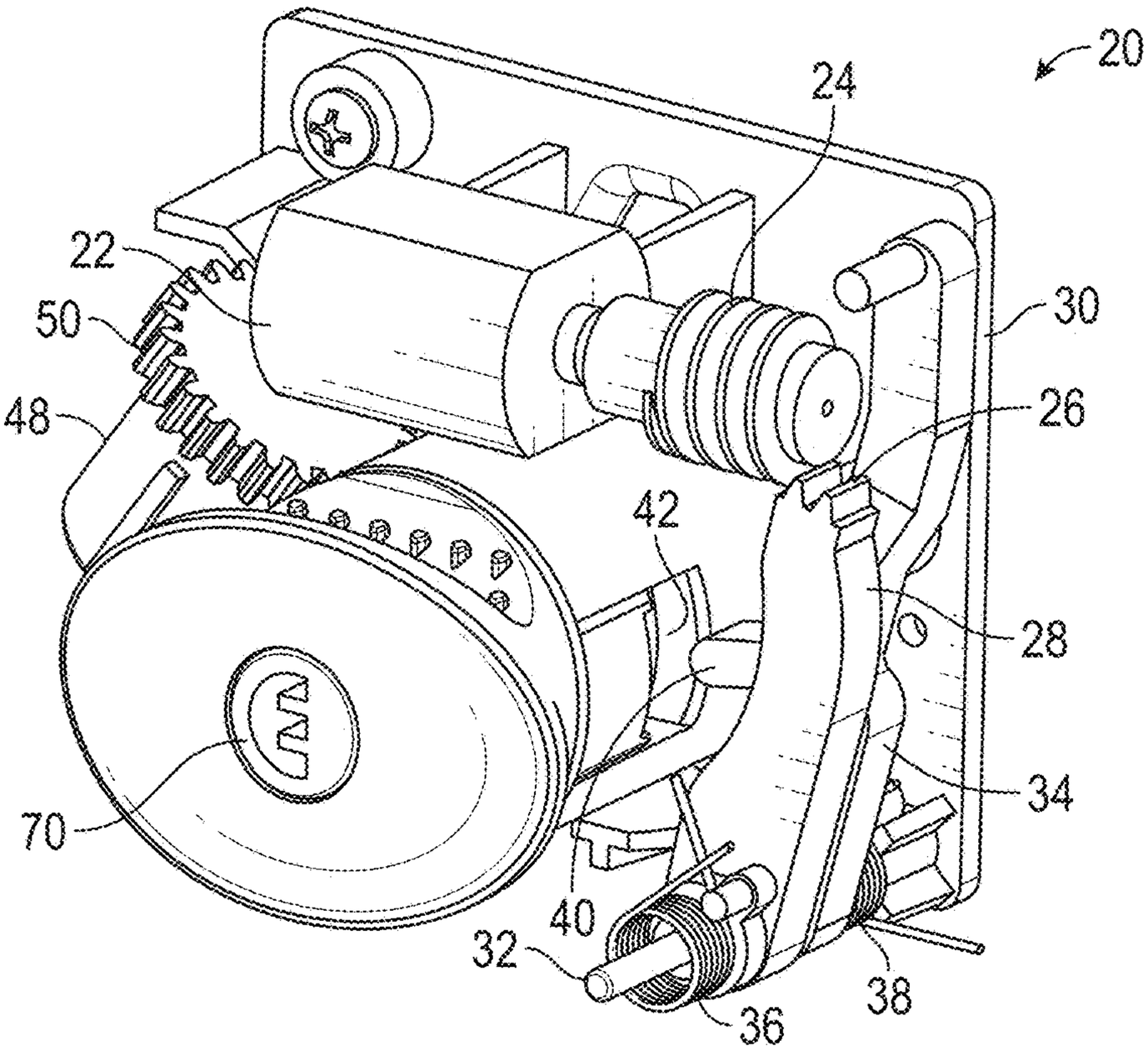
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FIG. 6

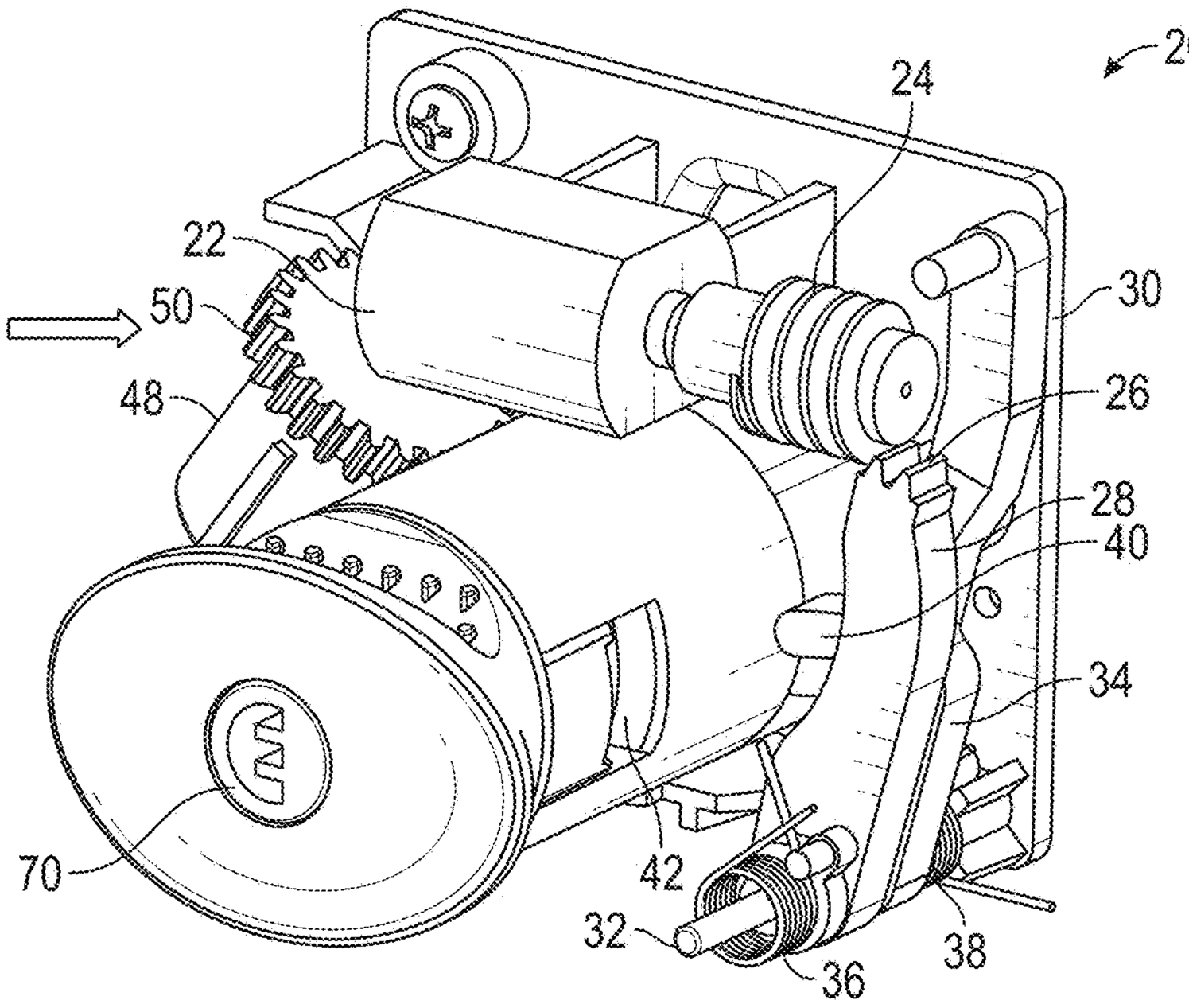
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FIG. 7

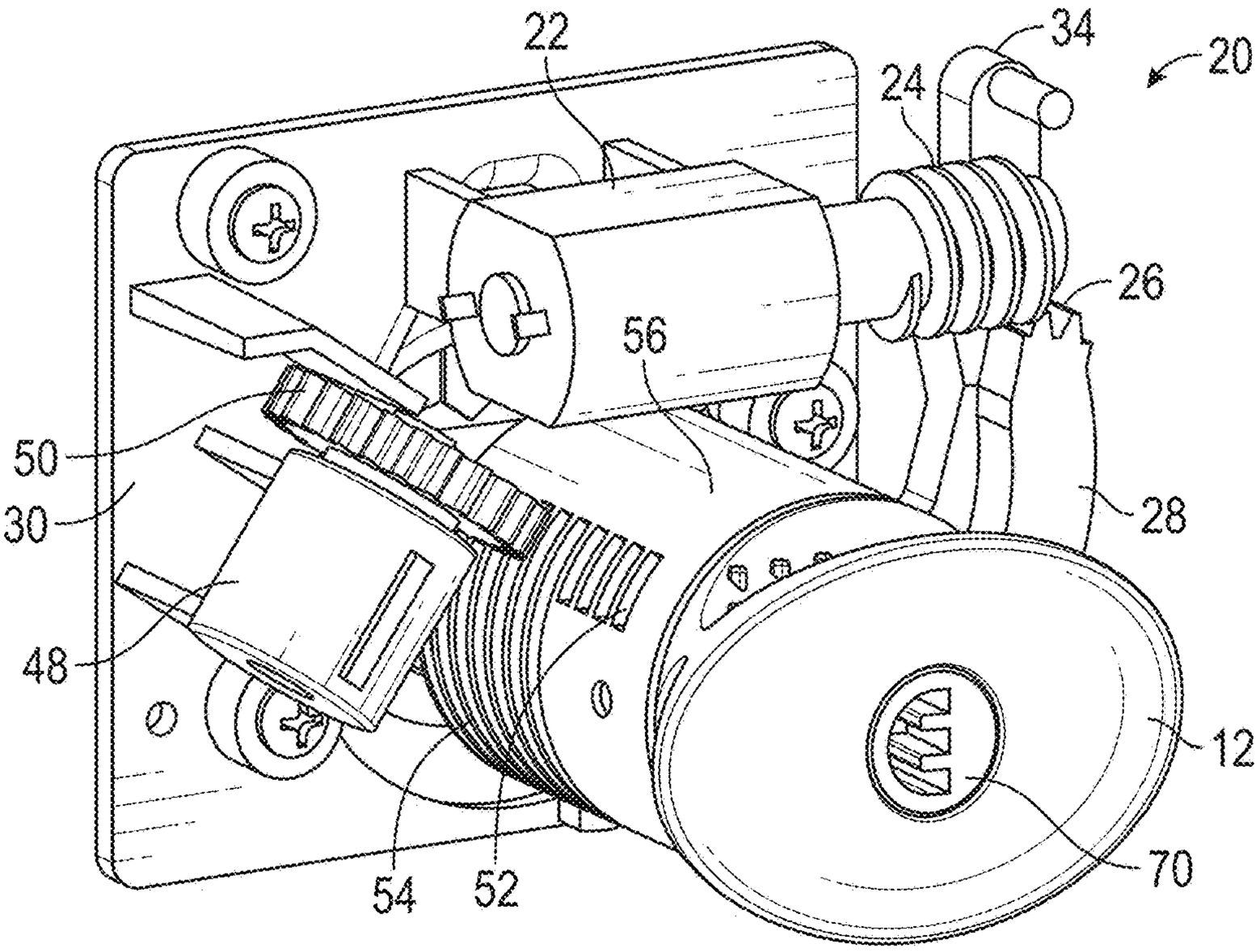
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FIG. 8

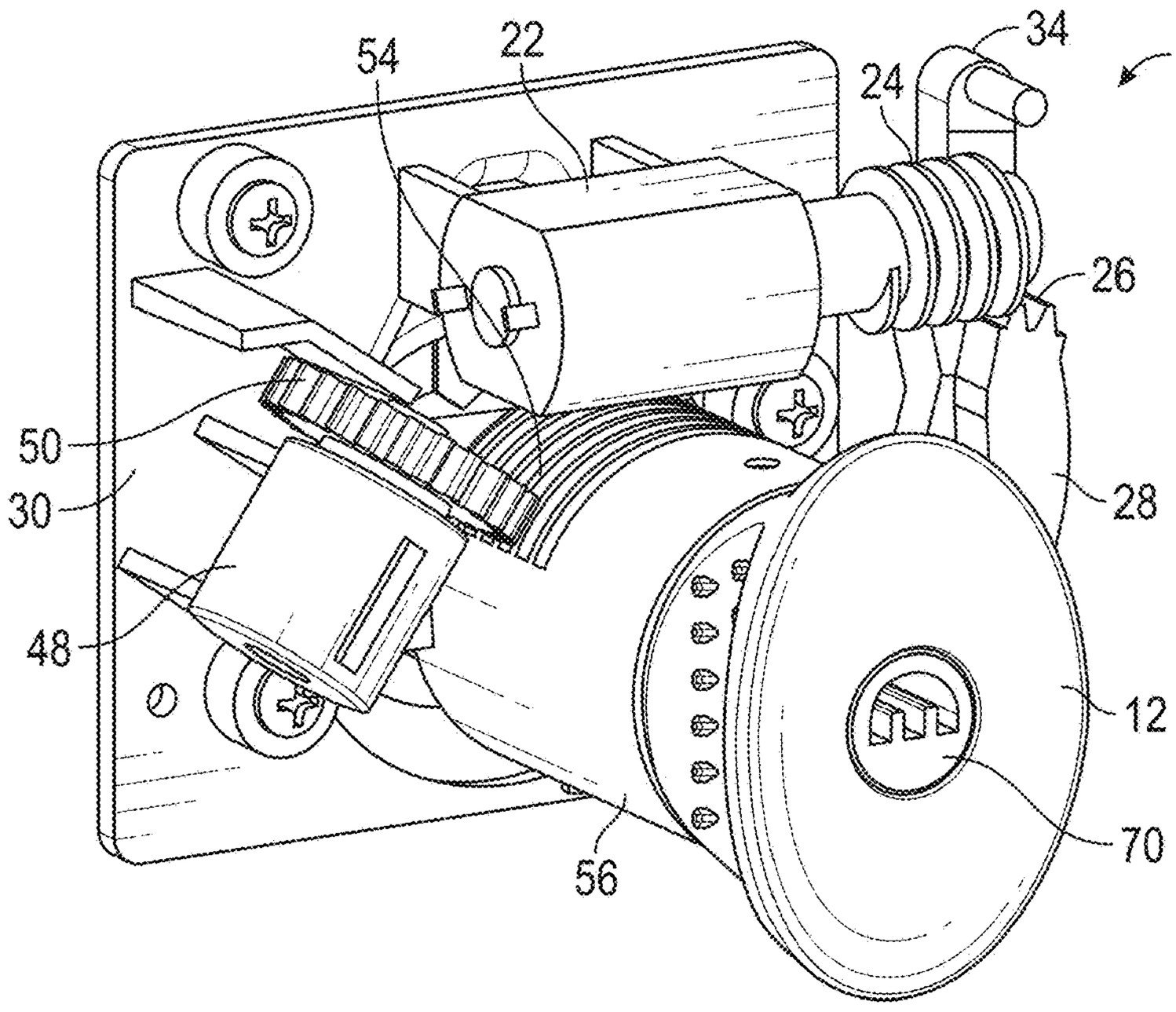
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FIG. 9

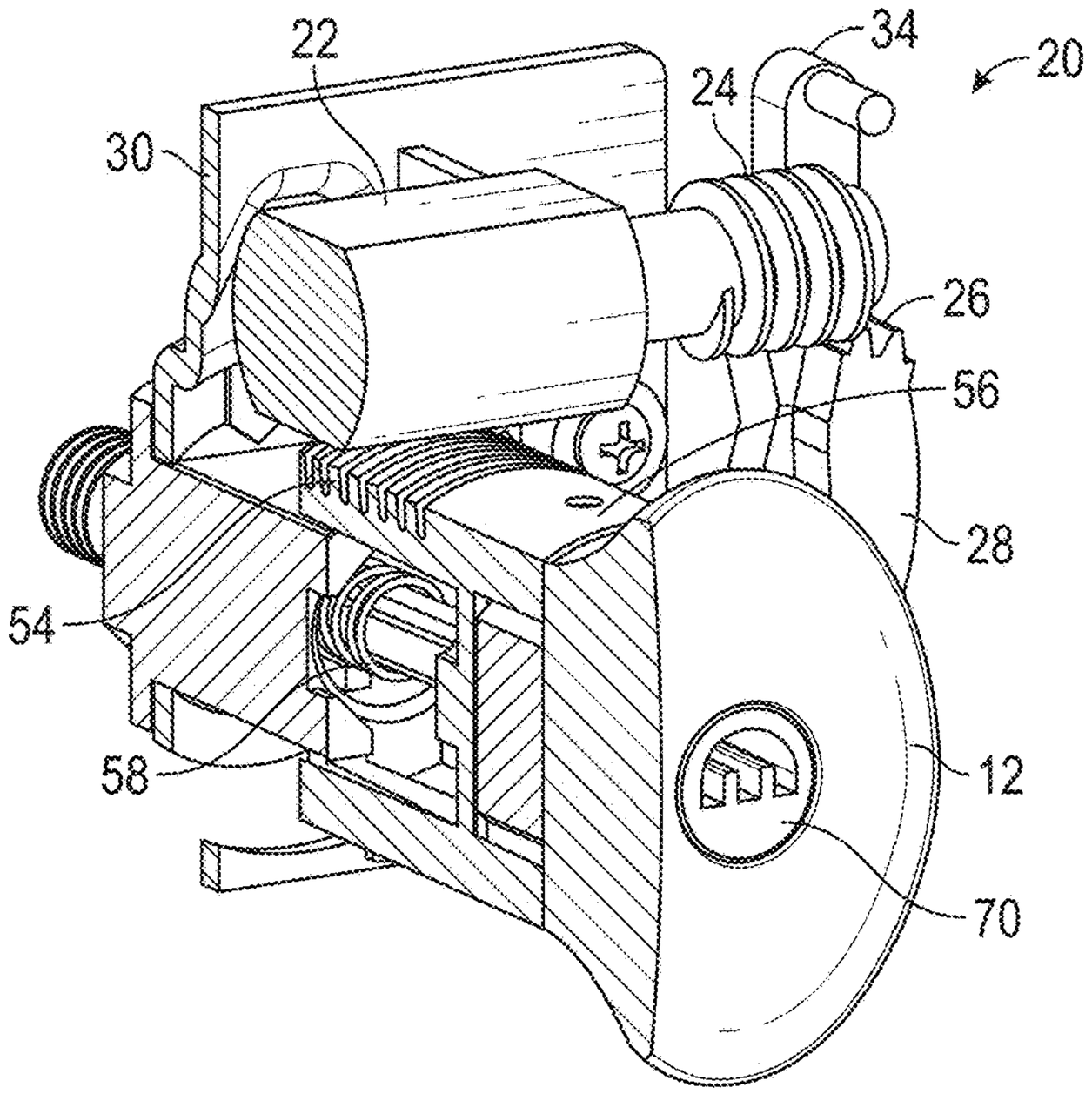
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FIG. 10

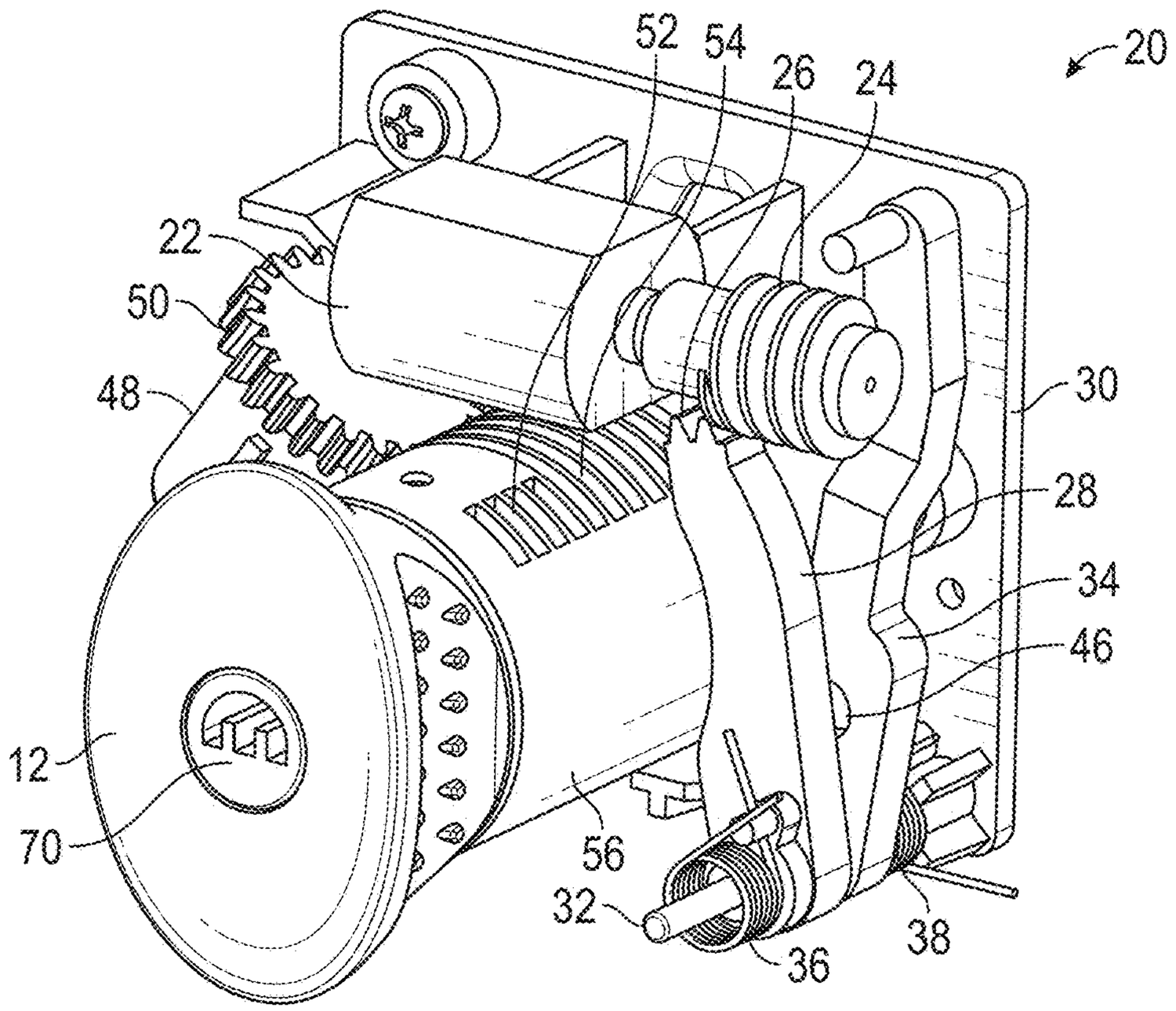
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FIG. 11

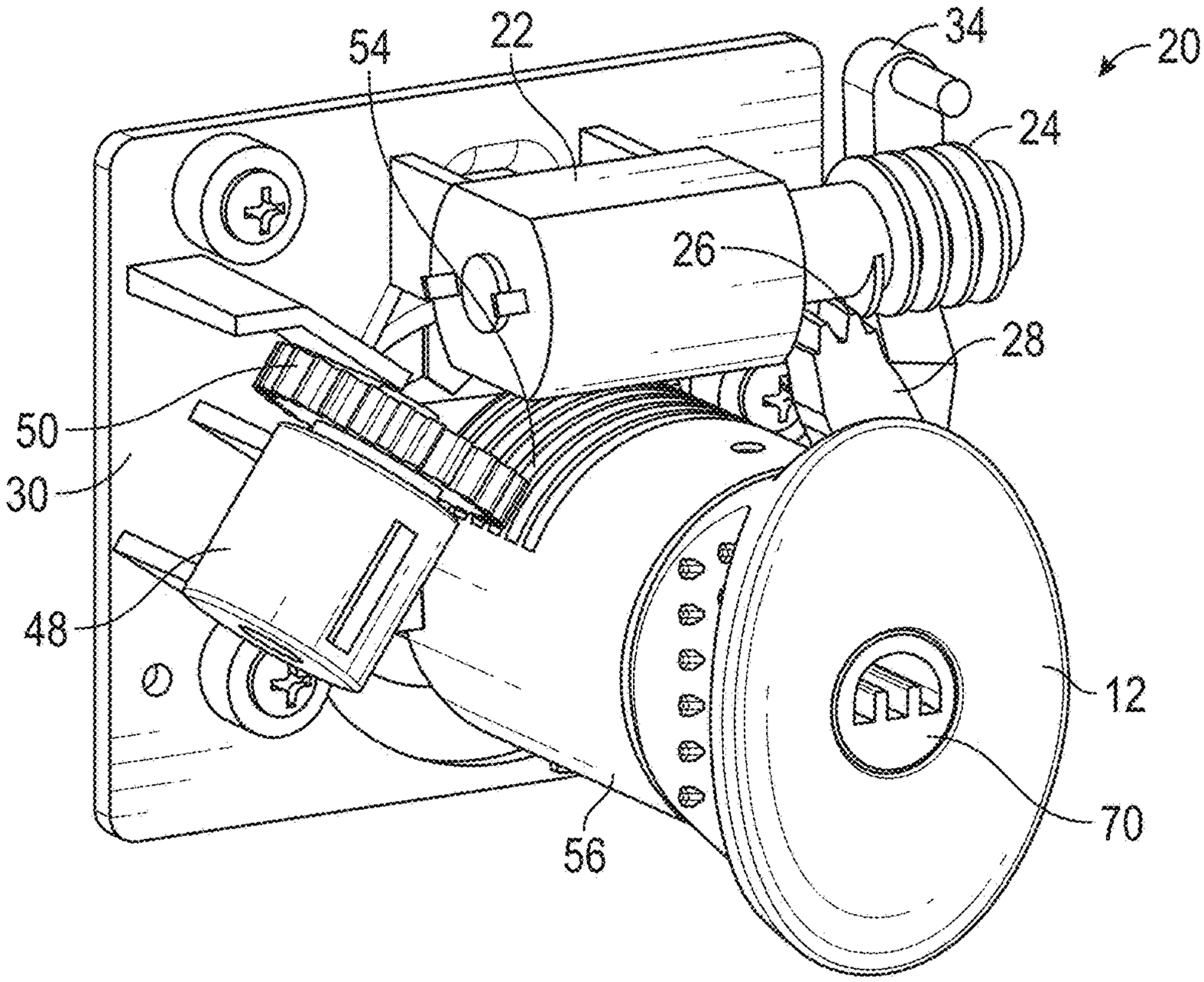
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FIG. 12

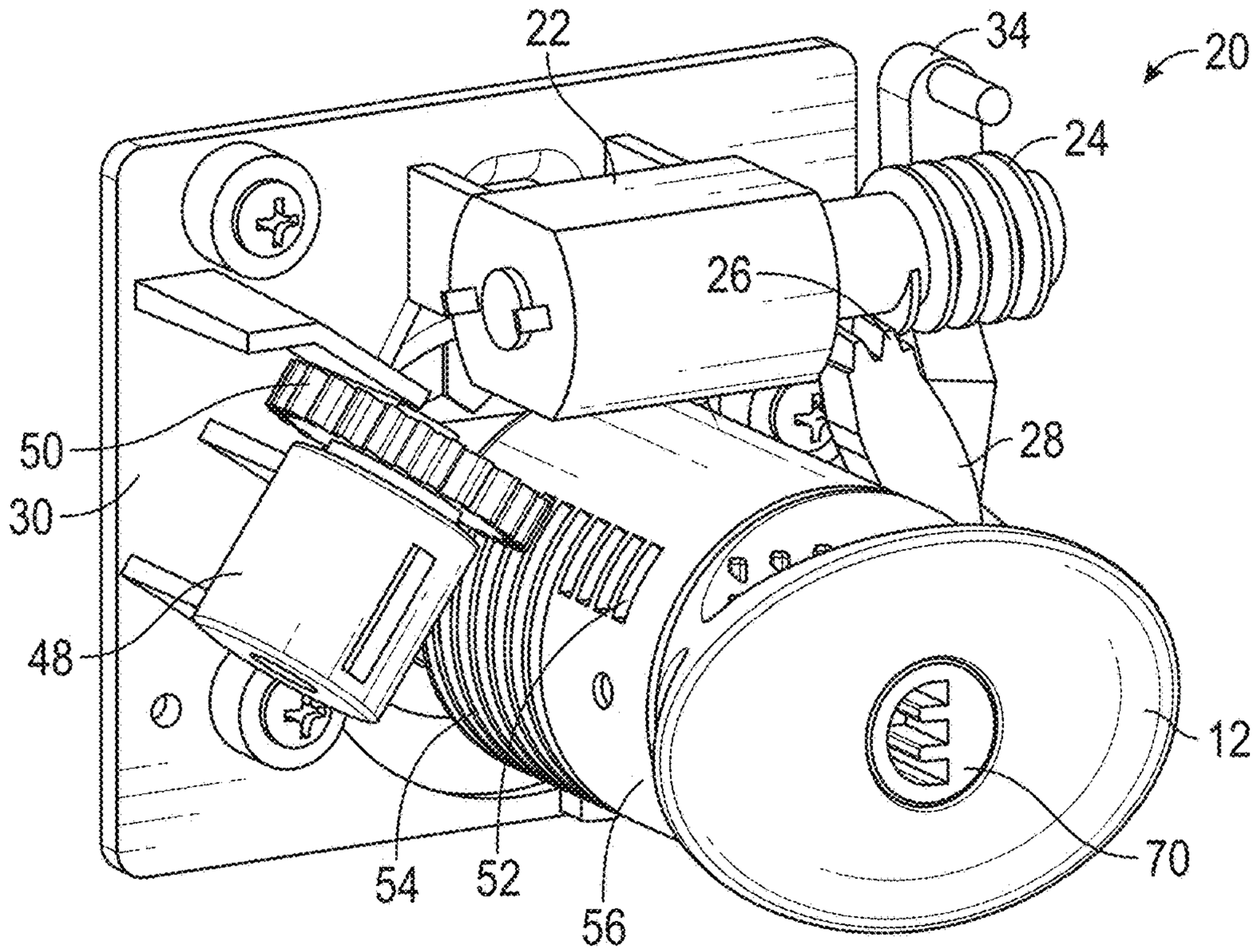
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FIG. 13

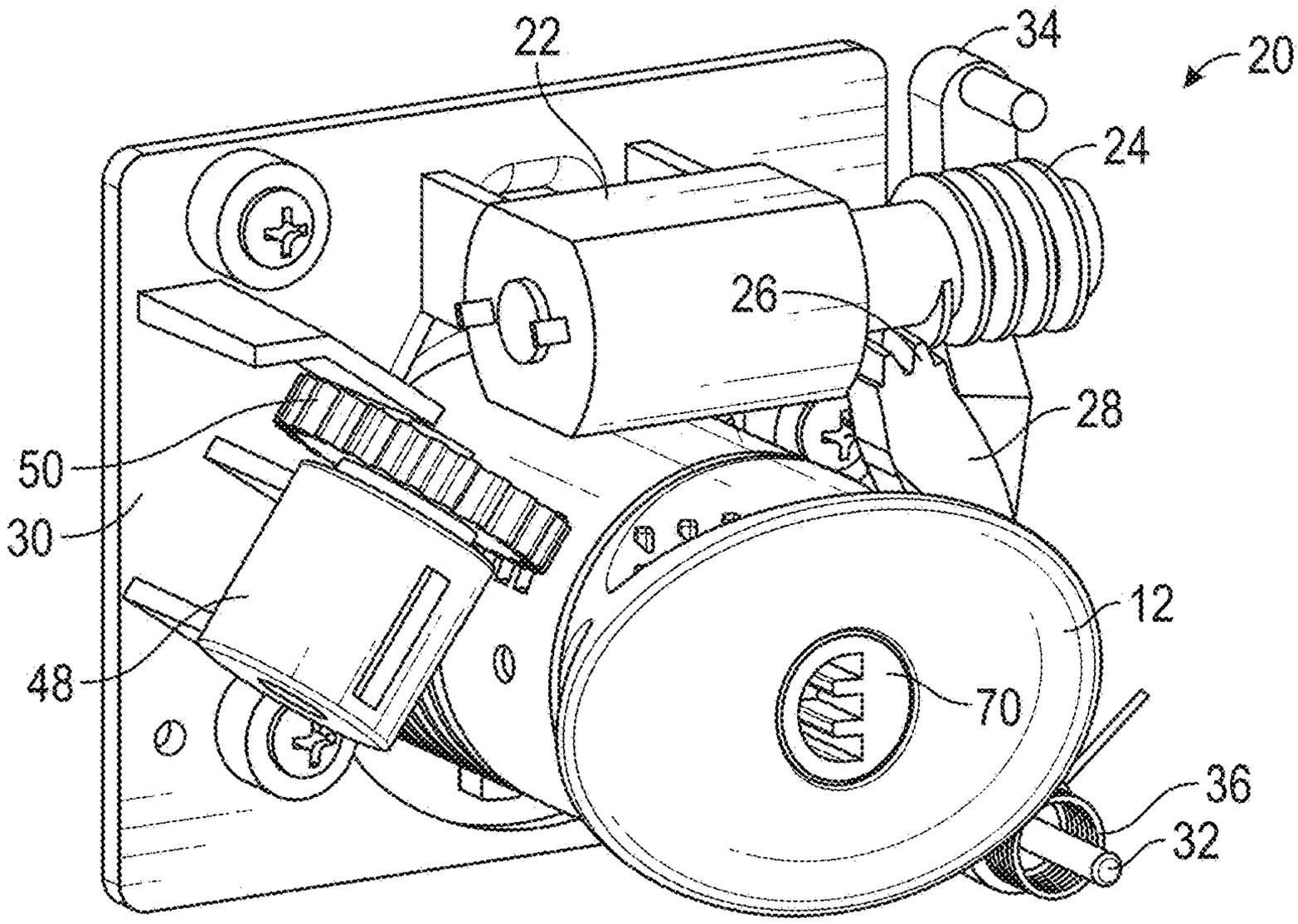
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FIG. 14

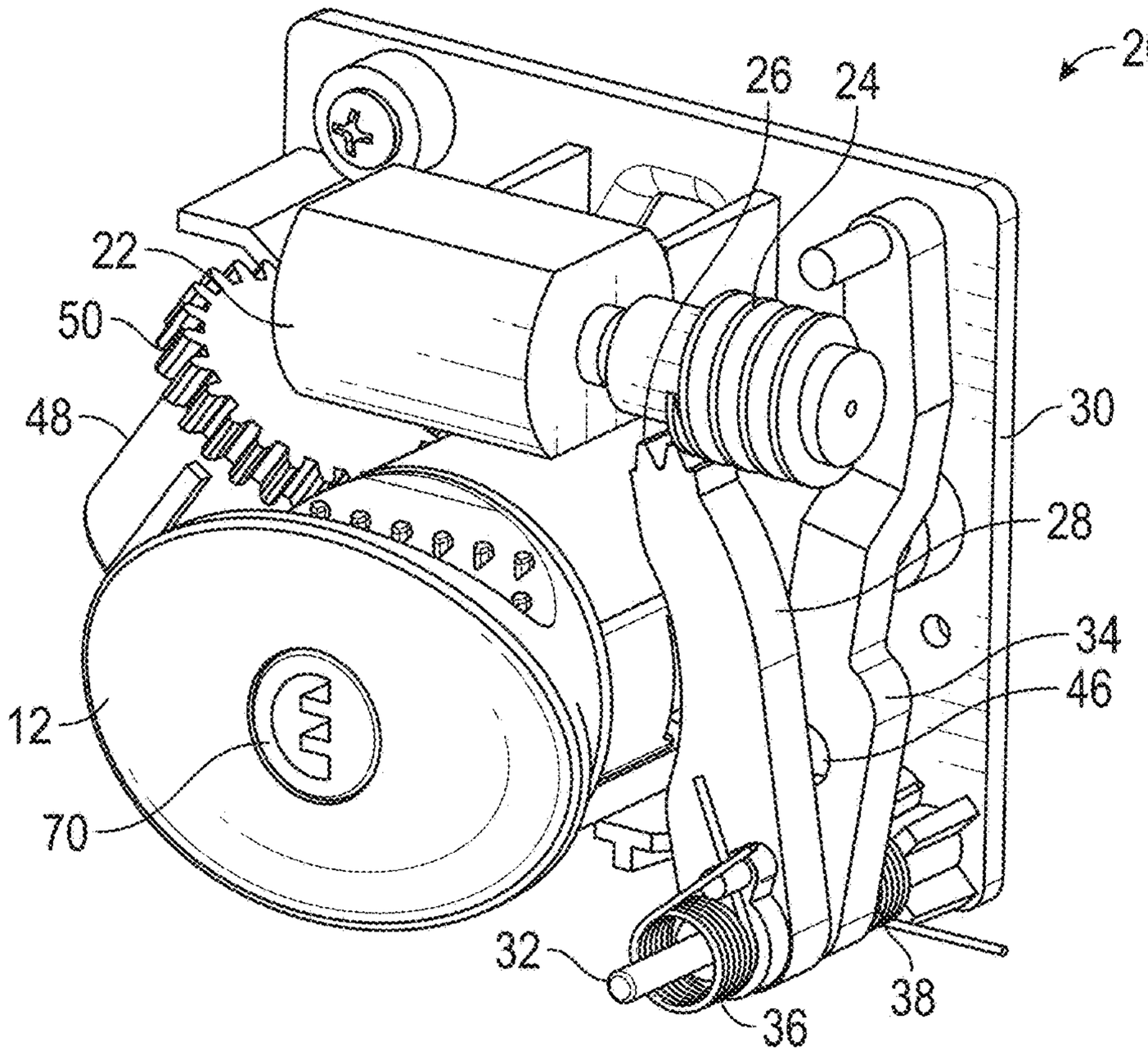
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FIG. 15

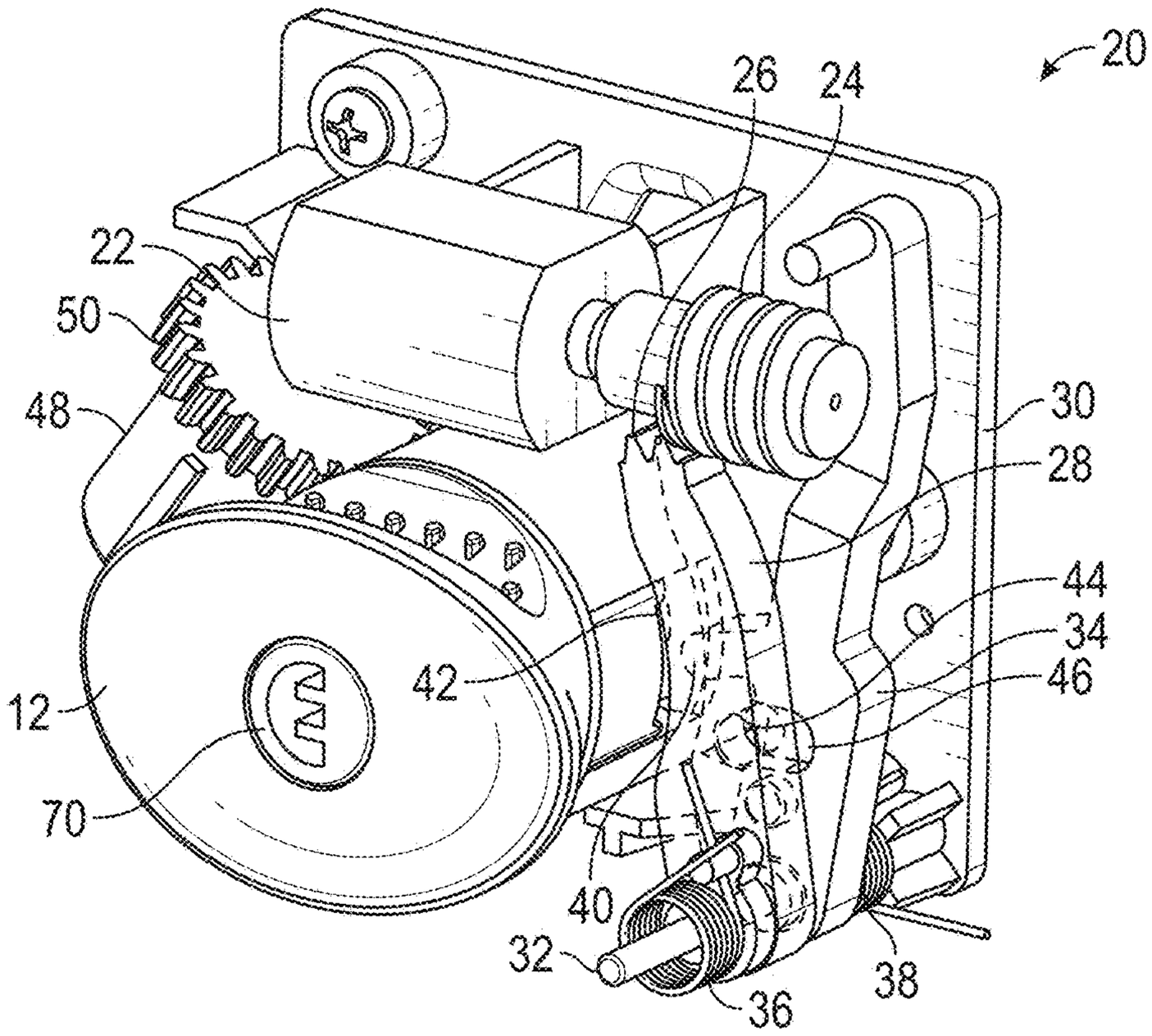
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FIG. 16

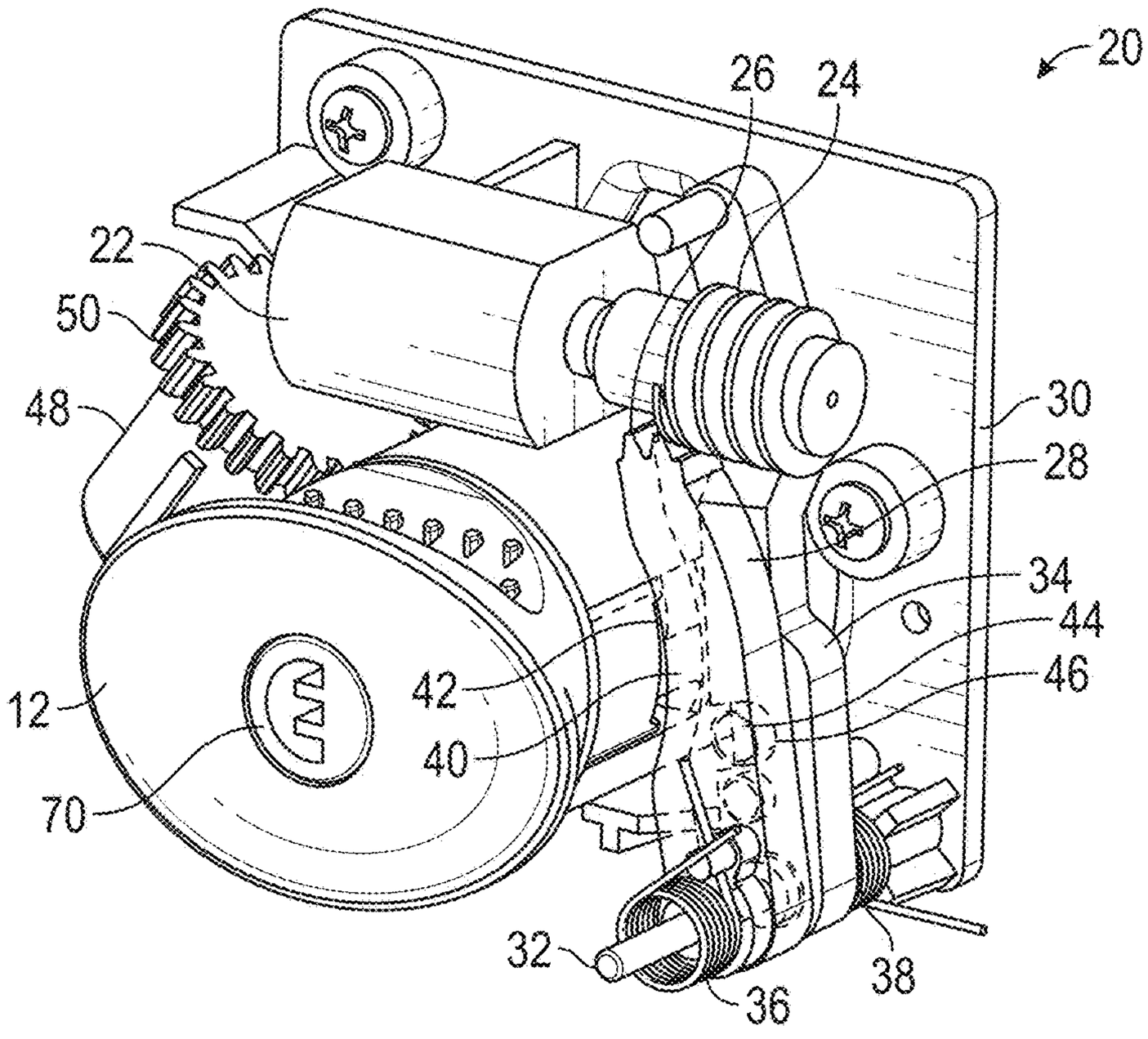
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FIG. 17

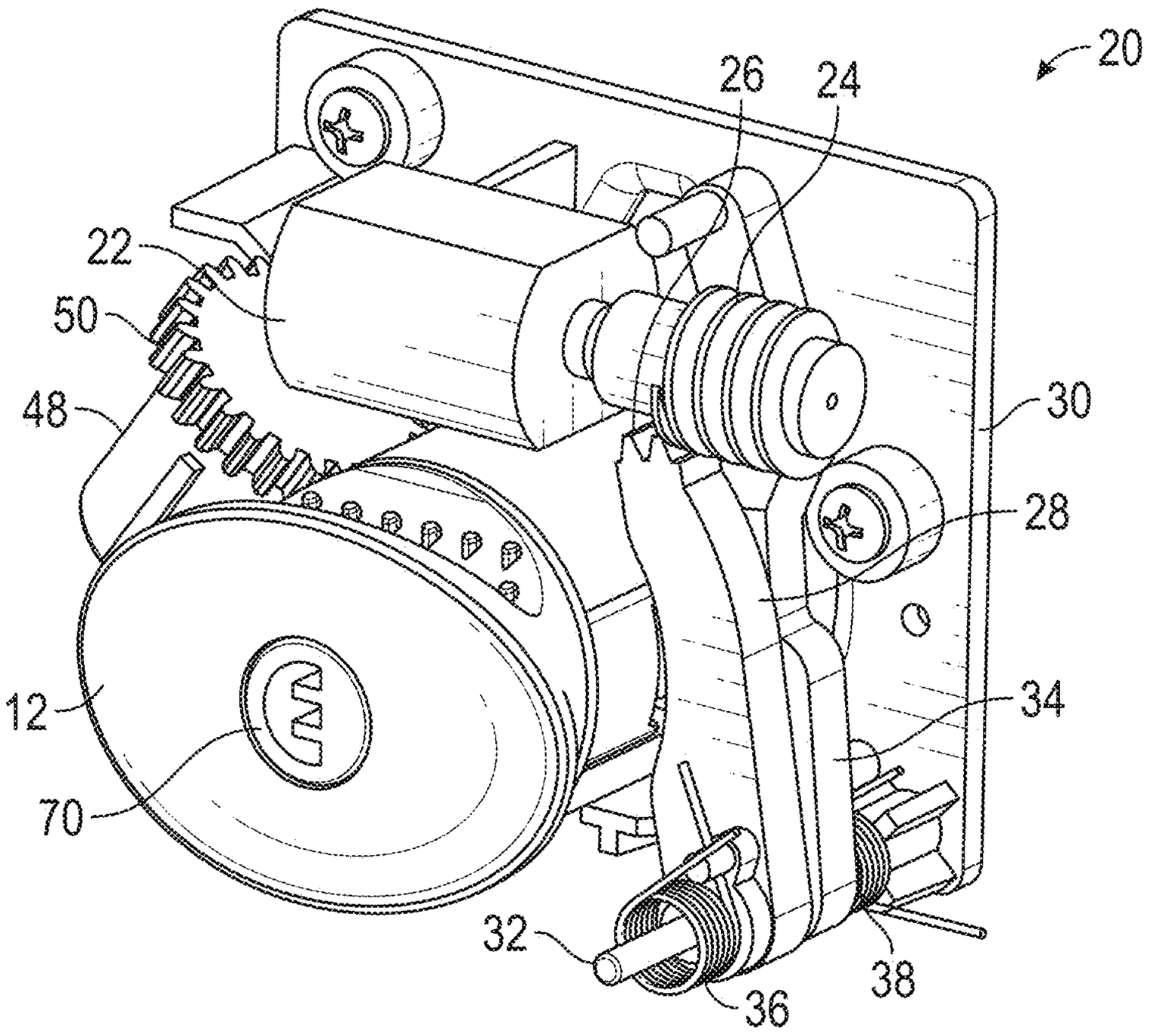

FIG. 18

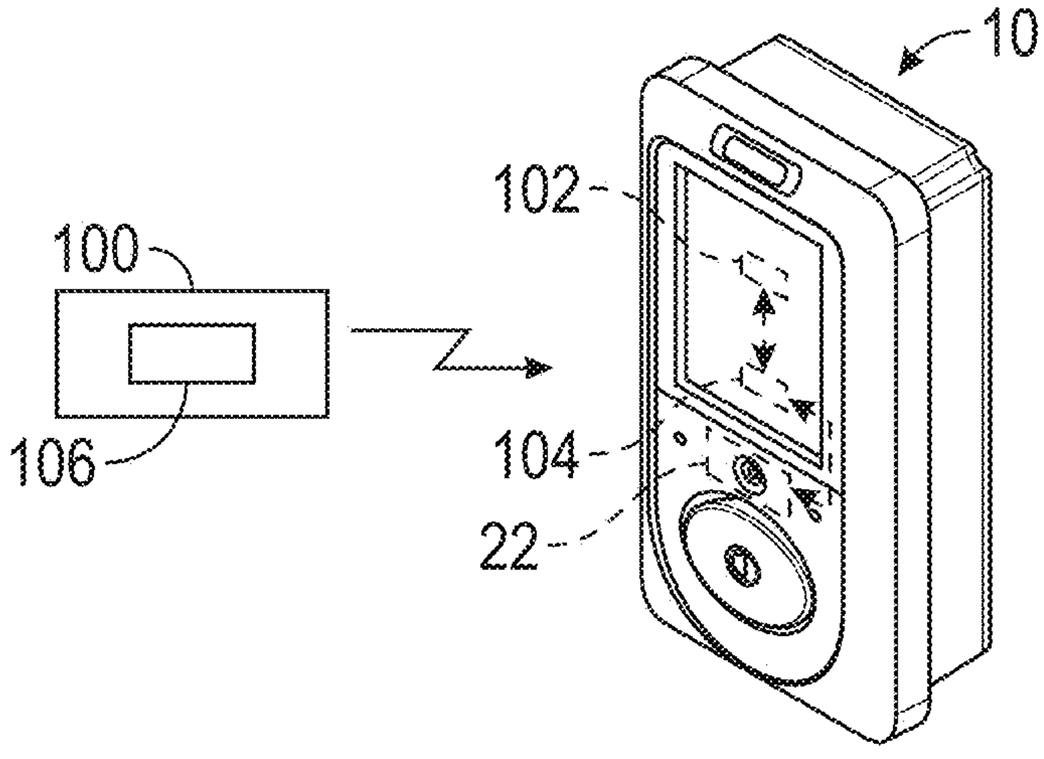

FIG. 19

LOCK WITH MOVABLE KNOB

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 15/885,127 filed on Jan. 31, 2018, which claims priority to U.S. Provisional Patent Application Ser. No. 62/452,874, filed on Jan. 31, 2017, the contents each of which are incorporated herein by reference thereto.

BACKGROUND

Exemplary embodiments of the present disclosure relate generally to locks for use with enclosures including but not limited to lockers.

Locks are used to secure or lock the door of lockers, cabinets, toolboxes, desks, and other such enclosures. In some applications, an associated knob is used manipulate or turn components of the lock or components secured thereto in order to open a door of the enclosure. Such knobs may be susceptible to damage.

Accordingly, it is desirable to provide a lock with a knob that is protected when not in use.

BRIEF DESCRIPTION

Disclosed is a lock, including: a retractable knob; and a knob release mechanism for retaining the retractable knob in a retracted position, wherein the knob release mechanism includes a damper with a gear that is slidably received within a set of grooves located in the retractable knob, and wherein the gear prevents rotation of the retractable knob unless it is in an extended position.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the knob release mechanism may further include a primary arm and a secondary arm, wherein the secondary arm is configured to retain the retractable knob in the retracted position.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the knob release mechanism may further include a motor having a worm, wherein the motor when actuated pivots the secondary arm into the second position.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the worm may pivot the primary arm by engaging teeth of the primary arm.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the lock may further include a keypad for actuating the motor.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the lock may further include a touchscreen for actuating the motor.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the knob release mechanism may further include a primary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position and a secondary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position, wherein the secondary arm has a hook portion that is received in a cavity of the retractable knob when it is in the retracted position and the secondary arm is in the first position.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the knob release mechanism may further include a primary arm and a secondary arm, wherein the secondary arm is configured to retain the retractable knob in the retracted position and the primary arm has a protrusion configured to engage a slot of the secondary arm.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the retractable knob may be spring biased into an extended position.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the set of grooves may be located in an exterior surface of the retractable knob.

In yet another embodiment, a method for releasing a retractable knob of a lock is provided. The method including the steps of: spring biasing the retractable knob into an extended position; and retaining the retractable knob in a retracted position by a knob release mechanism; and damping movement of the retractable knob from the retracted position to the extended position with a damper.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the damper may further include a gear that is slidably received within a set of grooves located in the retractable knob.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the method may further include the step of preventing rotation of the retractable knob unless it is in an extended position.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, rotation of the retractable knob may be prevented by the gear.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the set of grooves may further include a first set of grooves and a second set of grooves, the second set of grooves having a greater length than the first set of grooves, wherein the first set of grooves are closer to a forward surface of the retractable knob.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the knob release mechanism may further include a primary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position and a secondary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position, wherein the secondary arm is configured to retain the retractable knob in the retracted position when it is in the first position.

In yet another embodiment, a lock system is provided. The lock system having: a lock, including: a retractable knob; a knob release mechanism for retaining the retractable knob in a retracted position, wherein the knob release mechanism includes a damper with a gear that is slidably received within a set of grooves located in the retractable knob, and wherein the gear prevents rotation of the retractable knob unless it is in an extended position; a receiver configured to receive wireless transmissions and wherein the receiver is in operable communication with a motor for actuating the knob release mechanism so that the retractable knob can be moved into the extended position; and a wireless key that communicates wirelessly with the receiver.

In addition to one or more of the features described above, or as an alternative to any of the foregoing embodiments, the

lock system may further include a microprocessor in operable communication with the motor and the receiver.

BRIEF DESCRIPTION OF THE DRAWINGS

The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

FIG. **1**A is a perspective view of a lock according to one embodiment in a first position;

FIG. **1**B is a perspective view of the lock of FIG. **1**A in a second position;

FIG. **1**C is a perspective view of the lock of FIG. **1**A in a third position;

FIG. **2**A is a perspective view of a lock according to another embodiment in a first position;

FIG. **2**B is a perspective view of the lock of FIG. **2**A in a second position;

FIG. **2**C is a perspective view of the lock of FIG. **2**A in a third position;

FIG. **3** is an exploded perspective view of the lock of FIG. **1**A;

FIGS. **4** and **5** are perspective views of a knob and knob release mechanism in a locked and fully retracted knob position corresponding to a first position;

FIG. **6** is a perspective of the knob and knob release mechanism wherein the knob release mechanism has been activated;

FIGS. **7** and **8** are perspective views of the knob and knob release mechanism wherein the knob release mechanism has been activated and the knob has been extended to an extended position or second position;

FIG. **9** is a perspective view of the knob and knob release mechanism wherein the knob release mechanism has been activated and the knob has been extended and rotated to a third position;

FIG. **10** is a partial cross-sectional view of the knob and knob release mechanism wherein the knob release mechanism has been activated and the knob has been extended and rotated to the third position;

FIGS. **11** and **12** are perspective views of the knob and knob release mechanism wherein the knob has been extended and rotated and the knob release mechanism has activated for a subsequent locking event;

FIG. **13** is a perspective view of the knob and knob release mechanism wherein the knob is extended but has been rotated back to its second position;

FIGS. **14-16** are perspective views of the knob and knob release mechanism wherein the knob release mechanism has been rotated back to its second position and pushed back into its retracted or first position;

FIGS. **17** and **18** are perspective views of the knob and knob release mechanism wherein the knob release mechanism has been rotated back to its second position and pushed back into its retracted or first position; and

FIG. **19** illustrates an alternative embodiment of the present disclosure.

DETAILED DESCRIPTION

A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

Referring now to FIG. **1**A is a perspective view of a lock **10** according to one embodiment of the present disclosure is illustrated in a first position, wherein a retractable knob **12** is shown in a first or retracted position. In FIG. **1**B the retractable knob **12** is in a second position or extended position. In FIG. **1**C the retractable knob **12** is rotated in the direction of arrow **14** to a rotated or third position from the second position. Rotation of the retractable knob from the second position to the third position will cause movement of a component secured to the lock **10** which will unlock a latch (not shown). The lock **10** illustrated in FIGS. **1**A-**1**C is operated by a keypad **16**.

Referring now to FIG. **2**A is a perspective view of a lock **10** according to another embodiment of the present disclosure is illustrated in a first position, wherein the retractable knob **12** is shown in a first or retracted position. In FIG. **2**B the retractable knob **12** is in the second position or extended position. In FIG. **2**C the retractable knob **12** is rotated in the direction of arrow **14** to the rotated or third position from the second position. Rotation of the retractable knob from the second position to the third position will cause movement of a component secured to the lock **10** which will unlock a latch (not shown). The lock **10** illustrated in FIGS. **2**A-**2**C is operated by a touch screen **18**.

In operation the lock **10** is unlocked by providing the proper combination to the lock **10** via the keypad **16** or touch screen **18**. Once this combination is provided a motor is energized and the knob **12** of the lock **10** is released from its first or retracted position so that it can move to its second position and thus be rotated to its third position thereby unlocking the enclosure the lock **10** is associated with.

FIG. **3** is an exploded perspective view of the lock **10** of FIGS. **1**A-**1**C.

Referring now to FIGS. **4-18** operation of a knob release mechanism **20** of the lock **10** is illustrated. The knob release mechanism **20** is actuated by operation of the keypad **16** or touch screen **18** as mentioned above. Once this occurs a signal is provided from a controller, microprocessor, microcontroller or other equivalent device in order to actuate or operate a motor of the lock **10**. In other words, the motor is in operative communication with the controller, microprocessor, microcontroller or other equivalent device and the keypad **16** or touch screen **18** is in operative communication with the controller, microprocessor, microcontroller or other equivalent device such that inputs from the keypad or touch screen are provided to the controller, microprocessor, microcontroller or other equivalent device in order to actuate or operate a motor of the lock **10**. In FIG. **4**, the knob release mechanism **20** is in a locked position and the knob **12** is in a fully retracted knob position corresponding to the first position. In this position, the lock **10** cannot be unlocked as the knob **12** is not free to rotate in the direction of arrow **14**. In accordance with an embodiment of the present disclosure, the knob release mechanism **20** includes a motor **22** for rotating a worm **24**. The worm **24** is configured to engage teeth **26** of a primary arm **28**, which is pivotally mounted to a carrier **30** for rotation about a pin **32**. The knob release mechanism **20** also includes a secondary arm **34** pivotally mounted to the carrier **30** for rotation about pin **32**. As mentioned above, operation of the motor **22** and thus the knob release mechanism **20** occurs via input of a correct combination into the keypad **16** or touch screen **18** of the lock **10**.

FIG. **4** illustrates the primary arm **28** and the secondary arm **34** each in a first position. The primary arm **28** is spring biased into the first position by a spring **36** and the secondary arm **34** is spring biased into the first position by a spring **38**.

In FIG. **5**, the primary arm **28** is shown in phantom illustrating a hook portion **40** of the secondary arm **34** that is received in a cavity **42** of the retractable knob **12** when the

secondary arm **34** is in the first position in order to retain the retractable knob **12** in the retracted position. Also shown is that the primary arm **28** has a protrusion **44** that engages a slot **46** of the secondary arm **34**.

In FIG. **6** the motor **22** has been activated due to the input of the correct combination to the keypad **16** or touchscreen **18** and the worm **24** has been rotated thereby pivoting the primary arm **28** and the secondary arm **34** into a second position wherein the hook portion **40** has been removed from the cavity **42** and the retractable knob is capable of moving from the retracted position to the extracted position shown at least in FIGS. **1**B, **1**C, **2**B, **2**C and **7-13**.

In FIGS. **7** and **8** the knob **12** has been extended to an extended or extracted position. Knob **12** is spring biased into the extracted or extended position by a spring **58** (FIG. **10**) such that as the primary arm **28** and the secondary arm **34** are pivoted to their second positions, the knob **12** moves outwardly to its extended position.

The knob release mechanism **20** further comprises a damper **48** that slows or retards the movement of the knob **12** from the retracted to the extracted position. In other words, damper **48** slows the outward movement of the knob **12** due to the spring biasing force of spring **58**. Damper **48** has a gear **50** that engages grooves **52** and **54** that are located on an exterior surface **56** of the knob **12**. Accordingly, gear **50** rotates about its axis and provides a slowing force to the outward movement of knob **12**. As is known in the related arts, the damper **48** may include a means such as a fluid or spring internal to the damper to provide resistance to the rotation of gear **50** about its axis as the knob **12** extends outwardly. As illustrated, the grooves **54** are longer radially than grooves **52** and grooves **52** are located towards the front of the knob **12** such that the knob **12** can only be rotated about its axis in the direction of arrow **14** to the third position when the knob **12** is in the extracted or extended position such that the teeth of gear **50** slide in grooves **54** as the knob is rotated.

FIG. **9** is a perspective view of the knob **12** and knob release mechanism **20** wherein the knob release mechanism **20** has been activated and the knob **12** has been extended and rotated to the third position.

FIG. **10** is a partial cross-sectional view of the knob **12** and knob release mechanism **20** wherein the knob release mechanism has been activated and the knob **12** has been extended and rotated to the third position. Also, illustrated is the spring **58** that biases the knob **12** into the second position.

FIGS. **11** and **12** are perspective views of the knob **12** and knob release mechanism **20** wherein the knob **12** has been extended and rotated and the knob release mechanism has activated for a subsequent locking event. In these FIGS., the primary arm **28** has been moved into its first position while the secondary arm **34** remains in its second position.

In FIG. **13** the knob **12** is extended but has been rotated back to its second position.

FIGS. **14-16** are perspective views of the knob **12** and the knob release mechanism **20** wherein the knob release mechanism **20** has been rotated back to its second position and pushed back into its first or retracted position.

FIGS. **17** and **18** are perspective views of the knob **12** and knob release mechanism **20** wherein the knob **12** has been rotated back to its second position and pushed back into its retracted position or first position. When this occurs, the hook **40** of the secondary arm **34** is pivoted into its first position by spring **38** and the knob **12** is retained in the retracted position against the biasing force of spring **38**.

In accordance with various embodiments of the present disclosure operation of the motor **22** is caused by providing the proper combination to the lock **10** via other keypad **16** or touch screen **18**. Once this combination is provided the motor is operated and the primary and secondary arms are rotated from their first positions to their second positions so that the knob **12** can be spring biased from its first position to its second position. As mentioned above, the damper **48** via gear **50** slows the outward movement of the knob **12**. Once the knob **12** is in its second position the teeth of the gear **50** are free to slide in grooves **54**.

In one embodiment, the lock **10** may also comprise a manual release or override via a key which is inserted into a master key cylinder **70**, which when turned will contact hook **40** of the secondary arm **34** and will rotate at least the secondary arm **34** from its first position to its second position so that the knob **12** can be extracted from its first position to its second position.

In another embodiment and as illustrated schematically in FIG. **19**, the motor **22** is energized via wireless communication (e.g., Bluetooth, WiFi, RFID, etc. or any other equivalent communication) with a key FOB, wireless key or other equivalent device **100** that communicates wirelessly with a receiver or receiver/transmitter **102** in operable communication with a microprocessor **104** or other equivalent device or the receiver/transmitter **102** directly communicates with the motor **22**. Accordingly and when the key FOB or other equivalent device **100** is within range of the receiver or receiver/transmitter **102** a transmitter **106** of the key FOB or other equivalent device **100** provides an actuation code to the motor **22** and the motor **22** is actuated in order to allow the knob **12** extend from the lock **10** as described above.

The term "about" is intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application. For example, "about" can include a range of ±8% or 5%, or 2% of a given value.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, element components, and/or groups thereof.

While the present disclosure has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the present disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from the essential scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this present disclosure, but that the present disclosure will include all embodiments falling within the scope of the claims.

What is claimed is:

1. A lock, comprising:

a retractable knob; and

a knob release mechanism for retaining the retractable knob in a retracted position, the knob release mechanism retains the retractable knob in the retracted position until a motor of the knob release mechanism is actuated by an input provided to a keypad located on a surface of the lock wherein movement of the retractable knob from the retracted position to an extended position is dampened by a damper, wherein the retractable knob is spring biased into the extended position.

2. The lock as in claim **1**, wherein the knob release mechanism includes the damper and the damper is provided with a gear that is slidably received within a set of grooves located in the retractable knob, and wherein the gear prevents rotation of the retractable knob unless the retractable knob is in the extended position.

3. The lock as in claim **1**, wherein the knob release mechanism further comprises a primary arm and a secondary arm, wherein the secondary arm is configured to retain the retractable knob in the retracted position.

4. The lock as in claim **1**, wherein the knob release mechanism further comprises a primary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position and a secondary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position, wherein the secondary arm is configured to retain the retractable knob in the retracted position when the secondary arm is in the first position.

5. The lock as in claim **4**, wherein the motor when actuated pivots the secondary arm into the second position.

6. A lock, comprising:

a retractable knob; and

a knob release mechanism for retaining the retractable knob in a retracted position, the knob release mechanism retains the retractable knob in the retracted position until a motor of the knob release mechanism is actuated by an input provided to a keypad located on a surface of the lock, the knob release mechanism including a primary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position and a secondary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position, wherein the secondary arm is configured to retain the retractable knob in the retracted position when the secondary arm is in the first position, and wherein the motor further comprises a worm and the worm pivots the primary arm by engaging teeth of the primary arm.

7. The lock as in claim **2**, wherein the set of grooves further comprises a first set of grooves and a second set of grooves, the second set of grooves having a greater length than the first set of grooves, wherein the first set of grooves are closer to a forward surface of the retractable knob.

8. The lock as in claim **7**, wherein the knob release mechanism further comprises a primary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position and a secondary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position, wherein the secondary arm is configured to retain the retractable knob in the retracted position when the secondary arm is in the first position.

9. The lock as in claim **1**, wherein the knob release mechanism further comprises a primary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position and a secondary arm pivotally mounted to the knob release mechanism for movement between a first position and a second position, wherein the secondary arm has a hook portion that is received in a cavity of the retractable knob when the retractable knob is in the retracted position and the secondary arm is in the first position.

10. The lock as in claim **1**, wherein the knob release mechanism further comprises a primary arm and a secondary arm, wherein the secondary arm is configured to retain the retractable knob in the retracted position and the primary arm has a protrusion configured to engage a slot of the secondary arm.

11. The lock as in claim **2**, wherein the set of grooves are located in an exterior surface of the retractable knob.

12. A method releasing a retractable knob of a lock, comprising:

spring biasing the retractable knob into an extended position;

retaining the retractable knob in a retracted position by a knob release mechanism;

releasing the retractable knob from the retracted position by actuating the knob release mechanism through an input provided to the lock; and

damping movement of the retractable knob from the retracted position to the extended position with a damper.

13. The method as in claim **12**, wherein the damper further comprises a gear that is slidably received within a set of grooves located in the retractable knob.

14. The method as in claim **13**, further comprising preventing rotation of the retractable knob unless the retractable knob is in the extended position, and wherein rotation of the retractable knob is prevented by the gear.

15. The method as in claim **13**, wherein the set of grooves further comprises a first set of grooves and a second set of grooves, the second set of grooves having a greater length than the first set of grooves, wherein the first set of grooves are closer to a forward surface of the retractable knob.

16. The method as in claim **12**, wherein the input is provided to a keypad or touch screen located on a surface of the lock.

17. A lock system, comprising:

a lock, comprising:

a retractable knob;

a knob release mechanism for retaining the retractable knob in a retracted position, the knob release mechanism retaining the retractable knob in a retracted position until a motor of the knob release mechanism is actuated;

a receiver configured to receive wireless transmissions, the receiver being in operable communication with the motor;

a wireless key that communicates wirelessly with the receiver; and

a microprocessor in operable communication with the motor and the receiver and wherein the knob release mechanism includes a damper that dampens movement of the retractable knob from the retracted position to an extended position, wherein the retractable knob is spring biased into the extended position.

18. The lock system as in claim **17**, wherein the damper includes a gear that is slidably received within a set of grooves located in the retractable knob, and the gear prevents rotation of the retractable knob unless the retractable knob is in an extended position.

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